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Estimation of Late Run Sockeye and Coho Salmon Escapement in the Clark River, a Tributary to Chignik Lake, Alaska Peninsula National Wildlife Refuge, 2003

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Key words: sockeye salmon, coho salmon, escapement, aerial surveys, subsistence, Chignik Lake, Alaska Peninsula National Wildlife Refuge

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Abstract.- Sockeye salmon *Oncorhynchus nerka* in the Chignik Lake system are an important species for commercial and subsistence harvest. In recent years, subsistence fishers in the Chignik area have had difficulty harvesting enough fish and are concerned that the runs have declined and may be over-exploited by the commercial fishery. This project was initiated to address these concerns, and the objective for 2003 was to estimate the escapement of late run sockeye and coho *O. kisutch* salmon in the Clark River. Stream walking surveys were scheduled to accomplish this objective in 2003. However, personnel issues prevented the ground surveys, and two aerial surveys were conducted. In October 2003, 6,100 sockeye salmon and 900 coho salmon were observed in the Clark River; 9,700 sockeye salmon and 300 coho salmon were observed in November 2003.

Introduction

The Chignik Lake/Black Lake system supports a viable commercial salmon fishery, primarily targeting sockeye salmon *Oncorhynchus nerka* (Pappas et al. 2003). Subsistence fishers from the villages of Chignik, Chignik Lagoon, and Chignik Lake also target late run sockeye salmon in Chignik Lake, and approximately 10,000 sockeye salmon are harvested in the subsistence fishery each year (ADFG 2002). Although subsistence harvest is not allowed within the Clark River, a tributary to Chignik Lake, late run sockeye salmon originating from this drainage are important to local subsistence users as the primary fish used for drying. Areas important to subsistence fishers in the Chignik villages include Hatchery Beach and the lake near the mouth of the Clark River and Home Creek. Subsistence fishing for late run sockeye salmon destined for the Clark River begins in late September and continues until freeze up. Although the earlier sockeye salmon runs destined for Chignik and Black lakes are fairly large, local subsistence fishermen favor the late run fish since they preserve better than sockeye salmon caught earlier in the season.

The Alaska Department of Fish and Game (ADFG) operates a weir on the Chignik River 4.5 km upstream from the entrance of the Chignik River into the Chignik Lagoon. The

Chignik weir is used to estimate escapement within the Chignik Lake/Black Lake system and to provide in-season management of the commercial fisheries (Pappas et al. 2003). Since the weir is pulled in early September, it only provides a drainage-wide escapement estimate prior to that date. The ADFG also conducts aerial surveys of the tributaries to Chignik Lake until early September.

The ADFG currently manages the Chignik Lake/Black Lake sockeye salmon fishery based on two different runs: an early run that spawns in tributaries to Black Lake, and a later run that spawns in Chignik Lake and its tributaries. The ADFG uses scale pattern analysis and run-timing to differentiate the Black Lake and Chignik Lake stocks (Witteveen and Botz 2003). Escapement goals at the Chignik weir are 400,000 early run sockeye salmon destined for Black Lake past the weir by 30 June, 250,000 sockeye salmon destined for Chignik Lake past the weir prior to 31 August, and a supplemental escapement objective of 25,000 late run sockeye salmon past the weir from 1 to 15 September (Nelson and Lloyd 2001).

Recently, subsistence fishers in the Chignik area have expressed concern that the late run Clark River stock has declined and that they are having a difficult time harvesting their subsistence fish. They are concerned that not enough fish are reaching the spawning grounds and that overall productivity might be decreasing. The U. S. Fish and Wildlife Service, King Salmon Fish and Wildlife Field Office (KSFO) initiated this project to address these subsistence concerns. The objectives of this monitoring project were to:

1. Estimate the total escapement of late run sockeye and coho *O. kisutch* salmon in the Clark River.

2. Estimate the escapement of Clark River sockeye salmon that pass the Chignik weir beginning in August until the weir is removed in early September.

3. Determine the run timing of Clark River sockeye salmon past the Chignik weir in August and September.

Objectives 2 and 3 were completed in 2002, and detailed methods, results, and discussion can be found in Anderson (2003), as can results of the efforts to accomplish Objective 1 in 2002. This report focuses on efforts to accomplish Objective 1 in 2003.

Study Area

The Chignik lake system is located on the South Alaska Peninsula about 270 km southwest of Kodiak Island, and is within the boundaries of the Alaska Peninsula National Wildlife Refuge (Figure 1). The system consists of two lakes: Black Lake and Chignik Lake, both of which are completely freshwater. Black Lake (the upper lake) has a maximum depth of 6 m, a surface area of 43 km^2, and an elevation of approximately 15 m above sea level (Narver 1968). The bottom is composed mainly of sand and silt, with

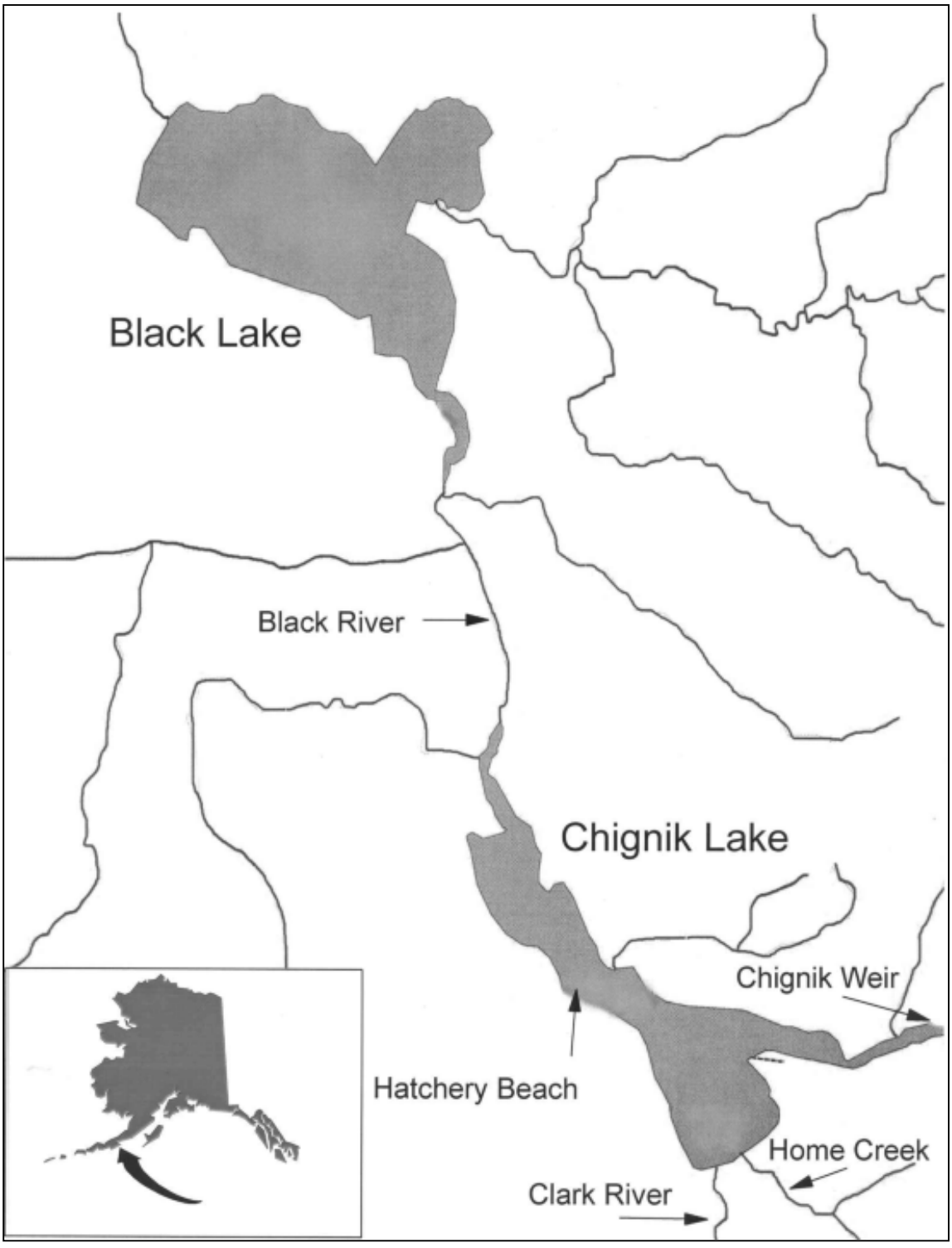

Figure 1. Chignik Lake study area, Alaska Peninsula National Wildlife Refuge, Alaska.

organic detritus prevalent near the outlet of the lake and in the northeast corner (Narver 1968). Chignik Lake has a maximum depth of 64 m, a surface area of 24 km^2, and an elevation of 5 m above sea level (Narver 1968). The bottom is dominated by rubble and boulders interspersed with gravel, silt, and organic deposits (Narver 1968).

In addition to sockeye salmon, the Chignik lake system also supports runs of chinook *O. tshawytscha*, coho, pink *O. gorbuscha*, and chum *O. keta* salmon. Dolly Varden *Salvelinus malma* also pass the Chignik weir in large numbers and are present throughout the system (Owen et al. 2000).

Methods

Foot surveys on the Clark River to count adult sockeye and coho salmon were scheduled to occur at two-week intervals beginning in mid-September and ending in December. However, due to personnel issues, these surveys could not be completed. Instead, aerial surveys were conducted using low-level helicopter flights. During counts, the pilot maintained the slowest airspeed possible at an altitude ranging from 15 to 50 m above the streambed, depending on the terrain and presence of trees and cliffs. When necessary, the aircraft hovered over large schools of fish and schools with mixed species to make counting easier. Complete circuits of the study areas were completed either moving upstream from the mouth or moving downstream from the headwaters. Direction of the surveys (upstream or downstream) was dictated by local wind and visibility conditions. Surveys were conducted between 10:00 and 15:00 hours to increase the likelihood of direct overhead sunlight, and polarized sunglasses were worn to reduce glare. Starting and stopping points for each stream survey reach were marked on topographic maps. During each aerial survey, total numbers of sockeye and coho salmon, as well as other species observed, were recorded for each reach. Lighting conditions (sun, partial overcast, overcast), water clarity (excellent, good, poor), and wind-generated surface turbulence (calm, moderate, rough) were qualitatively estimated for each reach. Locations of salmon spawning activity, large congregations of migrating or staging salmon, and locations and numbers of active fishermen were noted.

Two stream surveys were planned, one in early October and one in early November, and were scheduled based on weather forecasts and local stream conditions to avoid periods of turbid flow and inclement weather. The first survey was completed on 11 October 2003, and the second survey was completed on 22 November 2003. The mainstem Clark River (Figure 2) was surveyed until it branched into two smaller tributary streams with little flow. Survey reaches are considered index areas, and counts are considered minimum estimates of sockeye and coho salmon abundance. Our assumption is that periodic aerial counts will provide a minimum estimate of sockeye and coho salmon escapement.

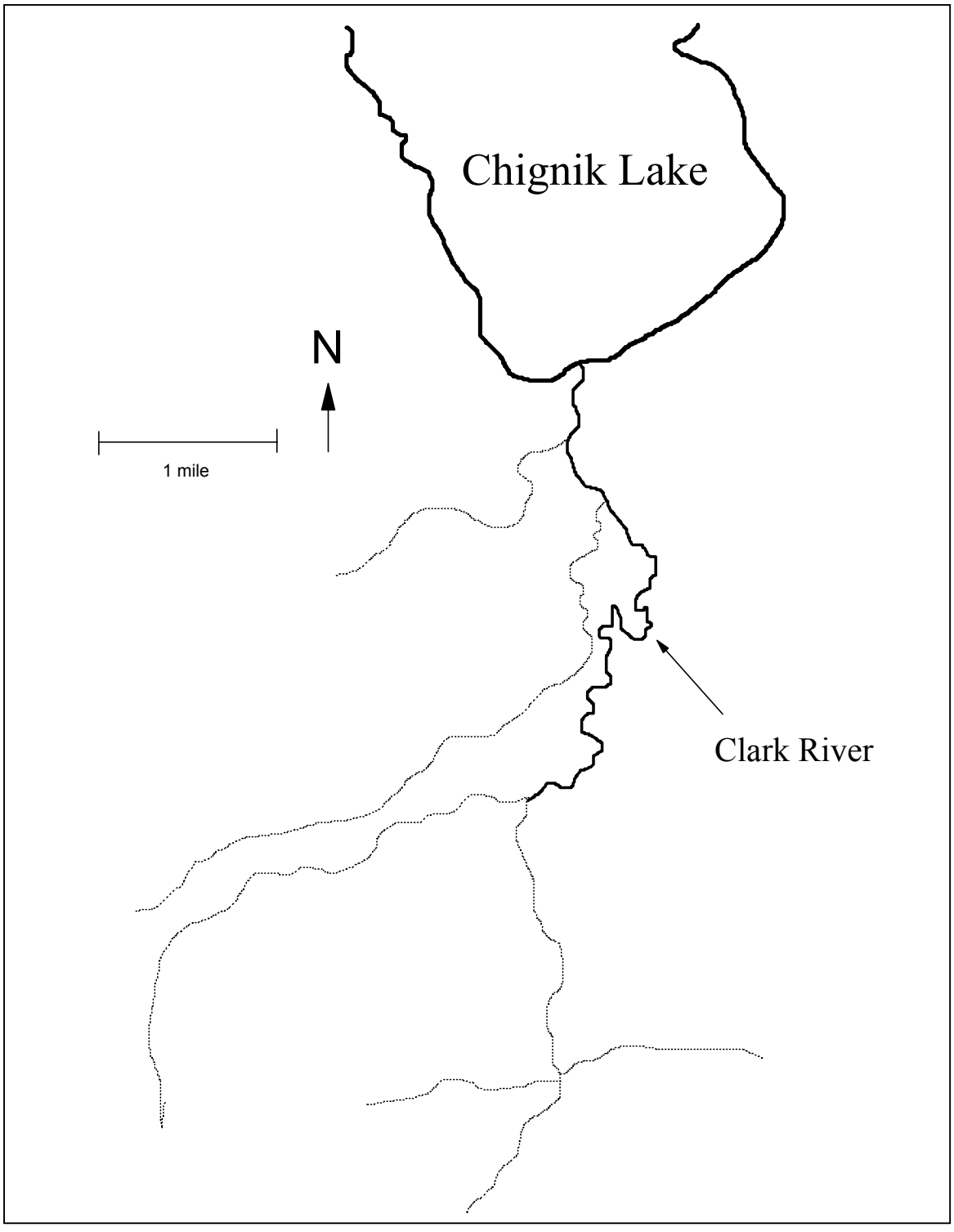

Figure 2. Clark River survey area, Alaska Peninsula National Wildlife Refuge. Streams shown with dashed lines were not surveyed.

Results

Large numbers of sockeye salmon were observed during both aerial surveys in 2003, and more coho salmon were observed during the October survey than in the November survey (Table 1). Surveys of the Clark River were conducted when lighting, water clarity, and surface turbulence allowed for good visibility of fish in the stream. Sockeye and coho salmon may have been present in smaller tributary streams that were not surveyed. However, due to logistical constraints (primarily fuel supply) and thick vegetation canopy, these smaller streams were not surveyed. As the entire drainage was not surveyed and count intervals were not adequate for expansion to area-under-the-curve estimates, surveys should be considered minimum counts of sockeye and coho salmon abundance for a given survey period, and not estimates of total abundance.

Discussion

The aerial surveys completed in 2003 provide minimum estimates of coho and late run sockeye salmon abundance for the Clark River during October and November. The ADFG flies aerial surveys in early September in the Chignik drainage to estimate the tributary escapement of early run sockeye salmon (Pappas et al. 2003). Local residents report sockeye and coho salmon entering the Chignik River after November. Therefore, it is likely that additional salmon entered the system after our scheduled surveys without being enumerated. It is also likely that sockeye salmon entered the river, spawned, and died between our two surveys and the ADFG surveys in September without having been observed. Perrin and Irvine (1990) report an average survey life for sockeye salmon of 13.2 days, well within the intervals between surveys.

In retrospect, conducting late season salmon surveys using a helicopter may have been the best method to use for the project. Walking surveys were attempted on the Clark River during 2002 (Anderson 2003) and in the Perryville area in 2002 and 2003 (Anderson and Hetrick 2003 and 2004 (*In review*)). High water prevented the crews from fully accessing and crossing the streams, and turbidity prevented observation of fish in the streams, all of which resulted in incomplete surveys. Weather and water conditions encountered during the surveys are very common for southwest Alaska during October and November. While finding a combination of good weather and clear water conditions can be challenging during fall and early winter, aerial surveys provide the best opportunity to provide counts of salmon escapement.

Table 1. Numbers of fish observed during aerial surveys in the Clark River, 2003.

Survey	Sockeye salmon	Coho salmon	Dolly Varden
11 October	6,100	900	200
22 November	9,700	300	200

From the information provided by the radio tagging we conducted in 2002 (Anderson 2003), late run sockeye salmon spawn in other tributaries and lake areas as well as the Clark River. We recommend aerial surveys be conducted annually, and they be expanded to include these areas in addition to the Clark River.

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